PROCEEDINGS

OF THE

ROYAL SOCIETY OF EDINBURGH.

1840–1841. No. 18.

Monday, 7th December 1840.

Sir T. M. BRISBANE, Bart. President, in the Chair.

The following communications were read:—

1. On certain Physiological inferences which may be drawn from the study of the Nerves of the Eyeball. By Dr Alison. Part First.

The principles which the study of the Nerves of Sensation and of Voluntary Motion within the Orbit is thought to illustrate, are:—

1. The peculiarity of the muscles of the Eyeball, that they receive few or no *sensitive* filaments, such as supply all other muscles of the body,—coupled with the peculiarity of their office, that they are designed, in the natural state, to be regulated, not by sensations excited in themselves by their action, but by sensations excited thereby in the Retina,—suggests an important reflection on the use of sensitive nerves and of sensations in guiding and regulating all voluntary and instinctive muscular motion; the sensations which *result* from the commencing action in every case fixing the effort of the will on the right muscles, and regulating

the extent to which the contractions shall be carried; while experience in some cases, and instinct in others, teaches what motor nerves must act, in order to excite the commencement of these sensations.

2. The *consentience* of different nerves, and thereby different muscles, in the performance of complex actions,—for example, the exact consentience of the nerves of the same pair on each side of the body in the acts of deglutition, respiration, coughing, sneezing, vomiting, straining, &c., is partly to be ascribed to the cause assigned by Müller,—the "conducting power of the medullary substance at the roots of the nerves, whereby those which lie contiguous to each other are apt to be affected simultaneously;" and this is probably the reason why the action of rolling the one eye *outwards*, being always intended to be performed simultaneously with the rolling *inwards* of the other, is excited by distinct nerves (viz., the 4th and 6th) from those which excite this latter movement; whereas the motion upwards and downwards, being intended to be performed simultaneously by the two eyes, is excited through one pair of nerves only, viz. the 3d. But it appears, from attending to the actions of the 4th and 6th nerves,—those which roll the eye outwards,—that this proximity of origin cannot be the main cause of consentience of action in motor nerves, the opposite nerves of these pairs never acting together in the natural state, but each always acting with a portion of the 3d nerve on the opposite side. And it thus appears, that the truly efficient reason of the consentience of motor nerves in all cases, and the only one which can be assigned in this case, is the *identity of the resulting and guiding sensation.*

3. The remarkable combination of movement observed in the actions of the 4th and 6th nerves on one side of the body and of a part of the 3d on the other, is conclusive proof that neither connection of nerves at their root, nor union in their course, is concerned in producing such combinations, and that the plexuses of nerves cannot be instrumental in producing any of the combinations observed among the muscles of the limbs.

But the use of the plexuses as to muscular motion becomes sufficiently obvious when we observe, that by this contrivance the sensitive nerves of every muscle in the extremities are placed in connection with a large surface of the spinal cord, and, therefore, probably the guiding sensations resulting from their action are evidently more distinct; and again, that the motor nerves of every muscle are connected with a larger surface of the spinal cord, and

may be acted on in consequence of the conducting power of the medullary substance, more energetically. The muscular sensations being more distinct, and the acts of the will being more energetic, the mind acts on the muscles thus supplied with more power and precision, and recollects and repeats the action, or succession of actions, with more certainty and uniformity than it otherwise could have done.

2. On the Plane and Angle of Polarization at the Surfaces of Crystals. By Professor Kelland.

The subject of Crystalline Reflexion has been treated by Mr MacCullagh and M. Neumann; but both these writers commence their investigations by assuming that certain equations hold true at the common surface of two media. The object of the present Memoir is to obtain such equations from mechanical considerations. To attain this, the following hypotheses are made:—1. That common light consists of vibrations, whose plane of motion is continually changing without law, or is indeterminate. 2. That light, polarized in a given plane, consists of vibrations perpendicular to that plane. 3. That the media consist of particles at sensible distances from each other, and acting mutually by a force which varies inversely as the square of the distance. 4. That, at the surface, a portion of the motion is destroyed by the sudden change from a motion in one direction to a motion in another. The nature of the medium which constitutes a crystal is defined by the direction which the ray takes within the crystal, as compared with its direction without. By means of these hypotheses, it is shewn that the following conditions result:—1. That the resolved parts of the motion in three directions are at the surface the same, whether estimated as belonging to the rays without or within the crystal; and, 2. That three other equations, derived from the former by a simple law of derivation, coexist with the above, and with them constitute the equations of relation between the incident, reflected, and refracted rays. These equations being solved give the position of the plane of polarization as determined by M. Neumann and Mr MacCullagh. They give also the polarizing angle in a form slightly differing from that obtained by the latter; but differing from it in such a manner as to agree (in the point of difference) with the formula of the former.

The following Donations were reported as having been received since the close of the last Session :—

The American Journal of Science and Arts. Conducted by Benjamin Silliman, LL.D. For January, April, July, and October 1840.—*By the Editor.*

Proceedings of the American Philosophical Society. January, February, May, June, July.—*By the Society.*

On the Heat of Vapours and on Astronomical Refractions. By John William Lubbock, Esq.—*By the Author.*

Researches in Embryology. (Second Series.) By Martin Barry, M.D., F.R.S.E.—*By the Author.*

Transactions of the Cambridge Philosophical Society. Vol. vii. Part 1.—*By the Society.*

Mémoires de la Société Physique et d'Histoire Naturelle de Génève. Tome viii. Part 2.—*By the Society.*

Transactions of the Society instituted at London for the Encouragement of Arts, Manufactures, and Commerce. Vol. lii. Part 2.—*By the Society.*

The Quarterly Journal of Agriculture; and the Prize Essays and Transactions of the Highland and Agricultural Society of Scotland. For June, September, and December.—*By the Society.*

Journal of the Asiatic Society of Bengal. For June, July, August, September.—*By the Society.*

Asiatic Researches; or Transactions of the Society instituted in Bengal for inquiring into the History, the Antiquities, the Arts and Sciences, and Literature. Vol. xix. Part 2.—*By the Society.*

De Graphite Moravico et de phænomenis quibusdam originem Graphitæ illustrantibus Commentatio. E. F. De Glocker. *By the Author.*

Proceedings of the Geological Society of London. Nos. 67 to 71. —*By the Society.*

Astronomische Nachrichten. Nos. 387 to 399.—*By Professor Schumacher.*

Memoirs of the Wernerian Natural History Society for the Years 1837–38. Vol. viii. Part 1.—*By the Society.*

Journal of the Royal Asiatic Society. May 1840.—*By the Society.*

Collecçao de Noticias para a Historia e Geografia das Naçoes

Ultramarinas que vivem nos dominios Portuguezes ou lhes sào visinhas; publicada pela Academia Real das Sciencias. Tomo v. No. 2.—*By the Royal Academy.*

Astronomical Observations made at the Royal Observatory, Edinburgh. By Thomas Henderson, F.R.S.E. Professor of Practical Astronomy. Vol. iii.—*By the Royal Society of London.*

Report on Education in Europe, to the Trustees of the Girard College for Orphans. By Alexander Dallas Bache, LL.D., President of the College.—*By the Author.*

Tijdschrift voor Natuurlijke Geschiedenis en Physiologie. Uitgegeven door J. Van Der Hoeven, M.D., Prof. te Leiden, en W. H. De Vriese, M.D., Prof. te Amsterdam. Deel vi. St. 4. Deel vii. Stks. 1. 2.—*By the Editors.*

Bulletin de l'Académie Royale des Sciences et des Belles Lettres de Bruxelles, 1840. Nos. 1 to 8.—*By the Academy.*

Brevi Cenni di Alcuni Resti delle Classi Brachiopodi di G. Michelotti.—*By the Author.*

De Solariis in Supracretaceis Italiæ Stratis repertis. Auctore Joanne Michelotti.—*By the Author.*

Transactions of the Geological Society of London. (Second Series.) Vol. v. Part 3.—*By the Society.*

The Rod and the Gun. Being Two Treatises on Angling and Shooting, by James Wilson, Esq. F.R.S.E., and by the Author of the "Oakleigh Shooting Code."—*By the Authors.*

Madras Journal of Literature and Science. 1839. July, September, and December.—*By the Editors.*

Oryctographie du Gouvernement de Moscow. Publiée par Gotthelf Fischer De Waldheim.—*By the Imperial Society of Naturalists of Moscow.*

Einiges gegen den Vulkanismus. Von B. M. Keilhau.—*By the Author.*

Notice sur les Gallas de Limmon. Par M. Jomard.—*By the Author.*

Notation Hypsométrique ou Nouvelle Maniere de Noter les Altitudes. Par M. Jomard.—*By the Author.*

Quelques Recherches sur la Chaleur Spécifique. Par MM. les Professeurs De la Rive et Marcet.—*By the Authors.*

Deuxième Mémoire sur les Variations Annuelles de la Température de la Terre a différentes profondeurs. Par A. Quetelet. —*By the Author*

Second Mémoire sur le Magnétisme Terrestre en Italie. Par A. Quetelet.—*By the Author.*

Résumé des Observations Météorologiques faites en 1839, à l'Observatoire Royal de Bruxelles. Par A. Quetelet.—*By the Author.*

Mémoires Couronnés par l'Académie Royale des Sciences et Belles Lettres de Bruxelles. Tome xiv. 1ere partie.—*By the Royal Academy.*

Fisica de Corpi Ponderabili ossia Trattato della Constituzione Generale dé Corpi del Cavaliere Amedeo Avogadro. 2 vols. 8vo.—*By the Author.*

Memorie della Reale Accademia delle Scienze di Torino. (Serie Seconda.) Tomo i.—*By the Academy.*

Proceedings of the Linnean Society of London. Nov. 6. 1838 to March 17. 1840.—*By the Society.*

Transactions of the Linnean Society of London. Vol. xviii. Part 3.—*By the Society.*

Ancient Laws and Institutes of England; comprising Laws enacted under the Anglo-Saxon Kings from Athelbirht to Cnut, with an English Translation of the Saxon; the Laws called Edward the Confessor; the Laws of William the Conqueror, and those ascribed to Henry the First; also Monumenta Ecclesiastica Anglicana, from the seventh to the tenth century; and the ancient Latin version of the Anglo-Saxon Laws.—*By the Commissioners on the Public Records of the Kingdom.*

Ordnance Survey of Ireland—County of Carlow in 28 sheets; and King's County in 49 sheets.—*By the Lord Lieutenant of Ireland.*

Disquisizione delle Dottrine sulla Struttura e sulle Funzioni del cuore e delle Arterie. G. M. Zecchinelli.—*By the Author.*

Footsteps of the Cheirotherium as shewn on Slabs of New Red Sandstone from Storeton Hill Quarry, Cheshire; illustrated in 3 plates.—*By Dr Buckland.*

Elements of Chemistry. By the late Edward Turner, M.D. Enlarged and revised by Justus Liebig, M.D., Wilton G. Turner, and W. Gregory, M.D. Part 3. No. 2.—*By the Editors.*

Transactions of the American Philosophical Society held at Philadelphia for promoting Useful Knowledge. (New Series.) Vol. vii. Part 1.—*By the Society.*

Mémoires de la Société des Sciences Naturelles de Neuchatel. Tome ii.—*By the Society.*

Mémoires de l'Académie Impériale des Sciences de Saint Petersbourg. (Sciences Mathématiques, &c.) Tome ii. Livns 3, 4.

Do. do. (Sciences Politiques, &c.) Tome iv. Livns 4, 5.

Do. do. (Sciences Naturelles.) Tome iii. Livns 1, 2, 3, 4.

Recueil des Actes des Séances Publiques de l'Académie Impériale des Sciences de Saint-Petersbourg, tenues le 29 Dec. 1838 et le 29 Dec. 1839.—*By the Imperial Academy.*

Voyage dans la Russie Méridionale et la Crimée. Par M. de Demidoff. Livns 2, 3, des planches.

Do. do. (Partie Scientifique) Livns 6, 7, 8, 9, 10, en 8vo, et planches en folio.—*By the Author.*

Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences de Paris 1840. 1er Sémestre No. 13, 14, 15, 16, 17, 18, 19.—*By the Academy.*

Mémoire sur la Formation de l'Indigo dans les Feuilles du Polygonum Tinctorium, ou Renouée Tinctoriale. Par Ch. Morren.—*By the Author.*

Recherches sur le Mouvement et l'Anatomie du Style du Goldfussia Anisophylla. Par M. Ch. Morren.—*By the Author.*

Twentieth Report of the Council of the Leeds Philosophical and Literary Society at the close of the Session 1839–40.—*By the Society.*

Essays and Heads of Lectures on Anatomy, Physiology, Pathology, and Surgery. By the late Alexander Monro, Secundus, M.D., F.R.S.E., upwards of fifty years Professor of Anatomy and Surgery in the University of Edinburgh. With a Memoir of his Life by his Son and Successor.—*By Dr Monro.*

Mr Greenough's Geological Map of England.—*By the Geological Society.*

A Collection of Specimens of Fossil Organic Remains.—*By Chevalier Michelotti of Turin.*

An Humble Address to her Majesty on the occasion of the Birth of the Princess-Royal was approved of, and directed to be transmitted for presentation to his Royal Highness the Duke of Sussex.

Monday, 21*st December.*

The Right Hon. Lord GREENOCK, V. P. in the Chair.

The following Communications were read:—

1. On the Polarization of the Chemical Rays of Light, by

Dr Sutherland, Liverpool. Communicated by the Secretary.

From a series of experiments made last summer, the author infers, in confirmation of the results obtained by Young, Berard, and Arago, that the chemical rays of light are subject to the same laws of interference and polarization as its luminous rays.

He found that the two images, produced by the sunbeam, and also by its extreme violet rays, when refracted through a calc-spar prism, quickly produce dark impressions, on being thrown upon photogenic paper, and that the extraordinary ray produces more effect than the ordinary one. He then observed, by alternately extinguishing and restoring the luminous rays with an analyzing apparatus of mica-plates, that the plane of polarization of the chemical rays, as indicated by the action on photogenic paper, corresponds with that of the luminous rays. He next ascertained, that, by means of a section of calc-spar rhomb, the polarized sunbeam, or the polarized violet ray, could be made to produce, on photogenic paper, a series of phenomena analogous to the coloured rings formed in the like circumstances by the luminous rays. But the effect of the violet rays was not so perfect as might have been desired, owing to the want of a contrivance for keeping the rays steadily for some time on the same part of the paper during the change in the sun's position.

The author farther found, that the chemical rays may be polarized by reflexion, and then equally exhibit the general properties which would be expected from a knowledge of those procured by the luminous rays. The sunbeam, reflected from a mirror of glass-plates upon an analyzing plate of flint-glass, and thence on photogenic paper, was observed to have scarcely any effect; but when the ray was rendered capable of reflection, either by turning the analyzing plate on its axis, or by interposing a plate of mica, a dark impression was soon formed.

Lastly, he ascertained that similar results might be procured by means of repeated single refraction, which was accomplished by two bundles of mica-plates so arranged in a tube as to admit of the planes of the bundles being either placed at right angles to one another, or made coincident. In the former case, the photogenic paper was not affected, but in the latter, it was speedily darkened. By a similar apparatus made of flint-glass, he succeeded in obtaining results of the same kind with the light proceeding from the sky.

2. On the Nutrition of Vegetables, by Dr H. R. Madden, Penicuik. Part First. Communicated by Dr Christison.

The object of the author in this part of his investigation, is to shew that the portion of the food of plants which they receive from the soil, and which he endeavours to prove is chemically combined with it,—although to appearance generically the same in all soils,—is not composed, as some imagine, of one single proximate principle, the same in all circumstances, but consists of several principles varying in their respective proportions in different soils. And he farther attempts to establish the general proposition, that the varying proportion of these principles may be one great cause of the relative fitness of different kinds of soil for the cultivation or nourishment of different kinds of vegetables.

In the course of explaining these views, which were supported chiefly by speculative considerations, but which the author hopes to confirm by experimental researches in which he is now engaged, he had occasion to refer to the doctrine recently advanced by Liebig, that the relative fitness of different soils to different plants seems to depend, not on the organic matter contained in them, but in a great measure on their relative composition as to saline ingredients corresponding or not corresponding with the composition and amount of saline ingredients in plants. The author controverts this proposition, and endeavours to prove by reference to the composition of those soils in which wheat reciprocally thrives or languishes, that Liebig's doctrine is untenable. It is well known that a sandy soil, which, after one process of manuring, will raise in succession an excellent crop of turnips, barley, hay, and oats, nevertheless does not answer at all well for wheat;—which, on the contrary, produces most abundantly on a clayey soil. Liebig holds the cause of this difference to be, that in sandy soils there is not enough of the saline ingredients, more especially of potash-salts, which are essential to the constitution of wheat. The author proves, however, by calculations founded partly on experiments by Liebig himself, and partly on experimental researches of his own, that sandy soil, after being properly treated with farm-yard manure, not only contains a much larger amount of saline matters, including potash-salts, than is required for the constitution of a superior crop of wheat-straw and grain, but likewise, that it actually supplies three times the quantity of salts, and among these, three times the quantity of potash, required for a fine wheat crop, to the turnips, barley, hay, and oats successively raised on it, and near-

ly double the quantity of potash necessary for the wheat to the turnips alone. These facts will appear from the following table:—

	Salts in an imperial acre of—	Total Salts.	Potash.
	Wheat, ...	358.3 lb.	50. lb.
The crops of a rotation after a single application of manure, viz.:—	Turnips, ...	389.7 ...	92.4 ...
	Barley, ...	310.0 ...	40.0 ...
	Hay, ...	200.0 ...	20.0 ..
	Oats, ...	207.0 ...	20.0 ...
	Total,	1106.7...	172.4...

3. On the Fossil Fishes of the Old Red Sandstone of Orkney. By Dr Traill.

The author stated, that besides the original localities at Skaill, Ichthyolites have been found at Breckness, Quoyloo, and Kirkwall, in Pomona, in South Ronaldshay, and in Papa-Westray. The species already recognised from these localities are, 1. Osteolepis macrolepidotus. 2. Osteolepis microlepidotus. 3. Cheirolepis Traillii. 4. Cheiracanthus minor. 5. Diplocanthus crassissimus. 6. Dipterus macrolepidotus. 7. Platygnattus paucidens. 8. Coccosteus latus. 9. Plerichthys Milleri. 10. Diplopterus Agassiz.

All but the last have been named by M. Agassiz, who determined the generic characters from specimens in the author's possession. The characters of the Diplopterus Agassiz are the following. The genus Diplopterus has two dorsal fins, similar and opposite to two anal fins; vertebræ continued into the upper lobe of a nearly even tail; and a wide mouth armed with strong conical teeth. It belongs to the Sauroid family of Ganoid fishes. The species D. Agassiz may be distinguished by a rounded snout; a large head almost equal to a fourth of its whole length; a single row of trigonal, hatchet-shaped scales on the ridge of its back, and oblique rows of rhomboidal scales passing from these to the abdomen; smooth scales, and the dorsal and anal fins rounded at their extremities, and composed of slender rays.

4. Mr Milne made a verbal communication respecting Instruments for registering Shocks of Earthquakes.

The advantages of registering earthquake shocks were first briefly noticed. 1. Such registers would shew whether, as supposed, the shocks were more frequent and violent during certain states of weather, and particular months of the year. If this were ascertained, some light would be thrown on the cause of the shocks, in so far at least

that it must be a cause which can be affected by atmospheric influences. 2. They would serve to shew whether the shocks that occur in this country coincide in time with those occurring in distant countries, and whether therefore they all originate from a common source, or are otherwise connected. 3. If there were instruments placed in different parts of an earthquaking district, the different effects of the same shock on these instruments would lead to the discovery not only of the precise spot on the earth's surface where the shocks were strongest, but likewise of the depth in the earth's crust from which they emanated.

The difficulty of devising proper instruments for registering the shocks, and especially of measuring their force, was next alluded to. As the instruments can only be made to operate by the movement of the earth's surface, the precise effects on the instruments cannot be anticipated, as the nature of that movement is as yet very imperfectly known. It seems probable from the observations made last year in Perthshire during the most violent shocks, not only that there is a change of level, but that there is also a slight progressive motion in the part of the earth's surface affected. In the construction of the instruments therefore, not only their gravitating tendency, but also their inertia, must be taken into account.

With the view of discovering what instruments could be employed for the purpose of registering the shocks, and of having them set in proper places, under the charge of careful and intelligent observers, a committee was appointed by the British Association at their last meeting in Glasgow.

A number of instruments had been proposed, several of which were explained; and three, recently constructed to be sent to Perthshire, were exhibited. Two of those exhibited were constructed on a principle suggested by Professor Forbes,—being an inverted pendulum, supported by a strong steel spring at the bottom, and loaded with a weight near the top, so that it should vibrate in the direction of the shock, whenever the floor of a house to which it may be attached shall change its horizontal position. The direction and the extent of vibration are indicated by marks left on paper by a soft black-lead pencil rubbing against it, affixed to the upper end of the pendulum. This instrument and most of the others explained appeared likely to be affected only by lateral or horizontal movements of the earth's surface. One or two were also suggested for the purpose of recording the vertical movements.

James Anstruther, Esq. was duly admitted an Ordinary Fellow of the Society.

The following Donations were presented:—

Elements of Chemistry, including the actual state and prevalent doctrines of that Science. By the late Edward Turner, M. D. F.R.S.L. & E. Edited by Justus Liebig, M.D., F.R.S.L. & E., and William Gregory, M.D., F.R.S.E.—*By the Publishers.*

A Tabular View of the yearly quantity of Rain which falls in different parts of Great Britain. By Joseph Atkinson, Harraby, near Carlisle.—*By the Author.*

Memoirs of the Royal Astronomical Society, vol. xi.—*By the Society.*

Astronomische Nachrichten,—Nos. 400 to 411.—*By Professor Schumacher.*

A Collection of Fossil Fishes from Orkney.—*By Dr Traill.*

4th January 1841.

Dr ABERCROMBIE, V.P. in the Chair.

1. On certain Physiological Inferences which may be drawn from the study of the Nerves of the Eyeball. By Dr Alison. Part Second.

The second part of Dr Alison's paper treated, *first*, of the inferences which may be drawn from the study of the Nerves of the Eyeball, touching the use of the Ganglia of the Sympathetic Nerve, which are now generally admitted to have essentially the same composition as the ciliary ganglion, *i. e.* to have motor as well as sensitive filaments from the spinal cord, besides the cords of communication with the other ganglia.

In the eye, as in other parts, the muscles supplied with nerves through these ganglia are muscles of *involuntary* motion. The supposition that this or any other part of the Nervous System is intended to *give* the power of motion to muscles, is quite hypothetical and opposed by facts; but there is nothing hypothetical in the assumption, that Sensations and Emotions of mind, which obviously affect the involuntary muscles, must do so through these ganglionic nerves; and therefore that the structure of these nerves and their ganglia must be designed to fit them for transmitting that kind of nervous action which attends those involuntary acts of mind, and to disqualify them for transmitting the direct influence of the will.

Taking this view of the subject, the following inferences are considered to be justified by facts known as to these ganglionic nerves in the eye and elsewhere.

1. That the vital endowments, both of sensitive and motor nerves, are much modified by passing through these ganglia,—that the influence of the will is not arrested by the ganglia, but is never felt to be exercised, and cannot be directed downwards to any specific object beyond them,—perhaps only because no distinct muscular sensations are transmitted upwards through these ganglia.

2. That muscles which have their nerves from the ganglia of the sympathetic may be affected by changes in the sensitive as well as in the motor nerves which enter those ganglia; and that the structure of the sympathetic nerve is fitted for *concentrating* on these involuntary muscles what the author terms *Sensorial Influence*, as distinguished from the effect of Volition; *i. e.* the influence of those changes in the nervous system which attend sensations and emotions of mind, and which obviously extend much more generally over the spinal cord and nerves than the effects of volition do.

Secondly, This part of the paper stated the appropriation of nerves of the fifth pair to the lachrymal gland, and the effects of section of that nerve on the nutrition of the eyeball, as clear proof, that those sensations and emotions of mind which affect the secretions and nutrition of the body, act downwards through the nerves of *common sensation*. The supposition of Müller and others, that the grey fibres of nervous matter are those destined to affect these organic functions exclusively, he regards as hypothetical, and opposed by pathological facts; but he assents to the opinion of Dr Marshall Hall, that it is probably with a view to the influence of emotion and sensation, passing *downwards* along the nerves of common sensation, that the ganglia are formed on the roots of those nerves.

The Secretary stated the substance of a communication by Mr Atkinson, on the subject of Rain-Gauges; and of another on an Instrument for Measuring the force of Winds.

The following Gentlemen were duly elected Ordinary Fellows of the Society:—

J. P. Muirhead, Esq.
James Hunter, M.D.
Colonel Morison, C.B. Madras Artillery.

The following Donations were presented:—

Bericht über die zur Bekanntmachung geeigneten Verhandlun

gen der Königl. Preuss. Akademie der Wissenschaften zu Berlin. Juli 1839 bis Juni 1840.—*By the Academy.*

Abhandlungen der Königlichen Akademie der Wissenschaften zu Berlin. 1832. Thiels 3 and 4, and 1838.—*By the Academy.*

Flora Batava. No. 120.—*By the King of Holland.*

Annuaire Magnétique et Météorologique du Corps des Ingénieurs des Mines de Russie. Année 1838. Par A. F. Kupffer.—*By the Author.*

18*th January* 1841.

The Right Hon. Lord GREENOCK, V.P. in the Chair.

The following Communications were read:—

1. On the Mode in which Musket-balls and other Foreign Bodies become enclosed in the Ivory of the Tusk of the Elephant. By John Goodsir, Esq. Communicated by Professor Syme.

The author commenced by stating, that "in all the specimens he had examined, two circumstances were at once detected; first, That the balls were enclosed, not in the true ivory, but in an abnormal structure; and secondly, that the holes by which the balls entered were either partially or completely cicatrized in cases of wound of the socket; which led him to suppose that, as the tusk is an organ of double growth, the membrane of the follicle and the pulp both play important parts in the process of enclosure, and that there is no regeneration of true ivory,—an hypothesis which was afterwards verified by observation. From a consideration of the opinions of Camper, Blumenbach, Lawrence, and Cuvier, it appeared that doubts are entertained as to the existence of cicatrices after wounds of the tusk, and opinions held as to the impossibility of the occurrence of such phenomena in a non-vascular substance like ivory. To investigate this subject with success, two principles must be kept in view: first, that a tusk is formed from within outwards, as well as from without inwards; and secondly, that the ivory and cement are never changed by vital action in form or substance, after their original deposition." With these two principles, the author proceeded to explain the healing of different wounds of the tusk, and the mode of enclosure of balls and other foreign bodies, by describing in detail the development and structure of the bony mass which appears in the pulp after wounds. He stated, 1. That wounds of the surface of the pulp are followed by ossification round the injury; 2. That the track of a ball across the pulp ossifies at the two extremities,

but not necessarily in the rest of its extent; 3. That the track ossifies when abscess ensues, or when it becomes fistulous; and 4. That balls and foreign bodies are always enclosed in a mass of ossified pulp. This ossified pulp, when examined in thin sections under the microscope, presents a formation identical with the irregular ivory which fills the pulp cavity of the tusks of the walrus, and the tusk of the cetacea, and consists of anastomosing Haversian canals, secondary medullary canals, and wavy bundles of Retzian tubes. These canals and tubes are situate in a clear matrix, in which there are occasional patches of coarse cells, through the medium of which the bundles of Retzian tubes communicate with one another, and with the tubes of the regular ivory. The formation of the irregular ivory which surrounds wounds, abscesses, and foreign bodies in the pulp, does not proceed indefinitely, but is limited by the closing up of the orifices of the Haversian canals, and the consequent separation of their contained ramifying pulp from the general system. The irregular ivory is then, in reference to the general pulp of the tusk, in the same relation as the regular ivory, and at length becomes enclosed in the latter by the transformation of the pulp on its surface. It was then stated that foreign bodies enter the pulp in three ways; 1. Through the base of the pulp, without wounding the ivory; 2. Through the free portion of the ivory; and 3. Through the sides of the socket. A case of the first kind is described by Mr Combe in the Philosophical Transactions. Wounds of the second kind, when there is no trace of the track of the ball, have, with the exception of the formation of the irregular ivory, been sufficiently explained by former authors. In reference to wounds of the third kind, Mr Goodsir demonstrated that cicatrices, partial and complete, do occur, and that they are produced by the plugging up of the hole from within by irregular ivory or ossified pulp, and from without by cement formed by the membrane of the follicle. In conclusion, it was stated that every case of wound, fracture, and enclosure of foreign bodies in ivory, might be explained by the facts, that a tusk was an organ of double growth, and that its follicle played an important part in the healing of wounds through the socket.

2. On the Theory of Waves. Part II. By Professor Kelland.

The present memoir is a continuation of that which the author presented to the Society in April 1839. It is divided into four sections. In the first (which is marked Section 4, in continuation

of the preceding memoir) the general problem of wave motion is treated of, and the equations to the surface are obtained by two different processes, giving results which agree with those obtained in the former memoir. In the second, the problem of wave motion in a canal of constant width and constant depth in the direction of the width, but of variable depth in the direction of motion, is treated by the method of the variation of parameters. The following are the approximate results :—1. The length of the wave diminishes directly as the depth diminishes. 2. That the velocity of transmission at any point is directly proportional to the square-root of the depth at that point. 3. That, in a channel uniformly and gradually shelving, the whole time of transmission of the wave from end to end, is exactly double what it would be if the depth were uniform; and, 4. That the elevation of the crest of the wave is inversely as the depth of the fluid.

Such of these conclusions as admit of testing, the author has compared with Mr Russell's experiments, given in the seventh volume of the Reports of the British Association. The data are, however, insufficient for effecting a satisfactory examination of the formula. There is, however, a very general agreement between theory and experiment. Section 6th is devoted to the determination of the velocity and force of the wave in a canal, the section of which, perpendicular to the direction of transmission, is some given curve; whilst the depth estimated in the direction of motion is constant. In the former memoir (Section II.) an approximate solution of this problem had been given, on the hypothesis of parallel sections. The conclusions then arrived at agree remarkably well with experiment, but the hypothesis is too limited to be universally applicable. In the present section, the problem of motion is solved in all its generality, and the condition of the bounding section is introduced in determining the arbitrary constants. But, general as the solution in this case appears, it is nevertheless subject to a particular hypothesis, viz., that at the *side* of the canal, and near the surface, the equations of motion are *continuous*. This hypothesis can hardly be objected to, in all cases where the variation of depth is uniform or gradual. But it totally fails when the variation is abrupt, and can with difficulty be conceived to apply when it is subject to much fluctuation. If, for instance, the section is triangular, we can have no hesitation in applying it; if, on the other hand, it is triangular at the bottom, and rectangular at the top, it utterly fails. One remarkable

feature in the results is, that the crest of the wave travels with the same velocity, whether at the edges or in the centre of the canal, provided the wave be of the simplest form. In a triangular canal, for instance, this is true. This result would, at first sight, appear to be utterly at variance with tide-observations; but the discrepancy will be less striking when it is remembered that observations of this kind are for the most part made in bays, or, as it were, small detached channels, and that consequently the times of high water registered are rarely those corresponding to the great tidal wave, but to a secondary to it, following at a considerable interval. However this be, Mr Russell states, that the conclusion coincides exactly with his experiments. Another result obtained in this section is, that the square of the velocity of transmission in a triangular canal is one-half that in a rectangular canal of the same greatest depth. This result was obtained in the former memoir, and agrees well with experiment. On adding further to the hypothesis, that the continuity extends to small distances below the surface, we find, as the result of an *accurate* solution (no longer using an approximation), that the approximate result is too great or too small, according as the breadth from the vertical, though the lowest point to the edge, is greater or less than the depth. The crest of the wave rises rapidly towards the shallow part of the fluid. The last section is occupied in deducing the circumstances of initial motion of a fluid.

3. Analysis of Berg-Meal from Umea Lapmark. By Dr Traill.

Professor Traill gave an account of the composition of a substance brought under the name of *Berg-Meal* from Swedish Lapmark by Mr Laing in 1838. It was found just under a bed of decayed mosses, forty miles above Degersfors, in Umea Lapmark. When examined by the microscope, it was found to consist of several species of minute organic remains, which Ehrenberg has considered as the siliceous skeletons of infusoria; the largest measured from 0.006 to 0.0005 of an inch. On analysis, Dr T. obtained 22 per cent. of organic matter, entirely destructible by a red heat; and he found the snow-white residue, which still retained the microscopic forms, to consist of 71.13 of silica, 5.31 alumina, and 0.15 oxide of iron. He considers the organic matter and the silica, as the essential ingredients, and the others probably as accidental. As a mixture with food, the quantity of organic mat-

ter in the Berg-Meal gives it a preference over the steatites and clays used for a similar purpose by some rude tribes.

John Miller, Esq. civil-engineer, was duly elected an Ordinary Fellow of the Society.

Professor Encke of Berlin, was admitted a Foreign Member of the Society.

The following Donations were presented :—

Journal of the Asiatic Society of Bengal. No. 97, 1840.—*By the Society.*

Madras Journal of Literature and Science. January to March, 1840 —*By the Society.*

Bulletin de la Société d'Encouragement pour l'Industrie Nationale pour les années 1838 et 1839.—*By the Society.*

Proceedings of the American Philosophical Society. No. 13.—*By the Society.*

Tijdschrift voor Natuurlijke Geschiedenis en Physiologie. Uitgegeven door J. Van der Hoeven, M.D. en W. H. de Vriese, M.D. Deel 7. Stks. 3, 4.—*By the Editors.*

Experimental Researches on the Strength of Pillars of Cast Iron, and other Materials. By Eaton Hodgkinson, Esq.—*By the Author.*

1*st February* 1841.

Dr ABERCROMBIE, V. P. in the Chair.

The following communications were read :—

1. On the force of Solar Radiation in the Arctic Regions, by Dr Richardson. Communicated by the Secretary.

Dr Richardson has reduced more carefully the Observations published in the Appendix to Franklin's Second Journey on the Force of Solar Radiation. From observations on a thermometer in the shade compared with those on a thermometer with blackened bulb in the sun, he finds a tolerably regular daily curve of radiation having its maximum at noon. But when (after allowing as far as possible for the disturbing influence of the wind) different months are compared, it is found that in spring the radiation is more intense than in summer after the disappearance of the snow, which Dr Richardson is disposed to attribute to a greater purity in the air at the former period.

Professor Forbes remarked, that, though Dr Richardson's experience on the superior purity of the air in spring could not be dis-

puted, yet it would require the most direct evidence to counterbalance the probability that the shorter path traversed by the sun's rays in summer would have the greater effect in determining their intensity. He considers the chief cause of the apparent anomaly to be, that the presence of the snow (to which Dr Richardson pointedly alludes), is mechanically effective in reflecting the solar light upon the sentient thermometer.

2. An attempt to reconcile the Theories of the Debacle and the Action of Glaciers, in accounting for the Distribution of Erratic Blocks. By Sir G. S. Mackenzie, Bart.

The author commenced by alluding to the disposition of geologists to draw conclusions of a general nature too hastily from the facts observed by them, illustrating this remark by referring to the various opinions successively promulgated, not only by geologists generally, but even by the same geological writer, on the subject of the till or boulder clay, the gravel, and sand, by which Great Britain is every where more or less covered. At one period, all these superficial deposits were referred to the action of water alone; now it is the fashion to explain them by the agency of glaciers.

In treating of the appearances presented by these deposits, the author observes, that those which at first sight might be thought to indicate tranquil deposition from water, might in reality be due to a different cause. There is sometimes the semblance of stratification, which arises from an internal movement and segregation of the different matters in the mass. As a proof that this phenomenon does often occur, the author mentioned that, in the old ramparts of Tours formed originally of rubbish, he observed that in a part where they were cut across to form a road, the materials had so arranged themselves as to exhibit stratified beds.

The author does not offer any positive opinion as to the truth of the theory, which implies that the above-mentioned superficial deposits are due to the erosion and movement of glaciers covering the whole surface of the country. He mentions, however, one locality in Ross-shire, where there are appearances on the lateral rocks of a valley strongly indicative of glacial erosion.

On the supposition that there are phenomena which indicate the action of water as well as of ice, in the formation of these superficial deposits, the author states the view which occurred to him, for embracing both of these agents, to be as follows:—He supposes that a volcanic eruption took place in the Icy Sea, some where to the north-west of the British Islands, which had the effect of break-

ing up the ice along the coasts, and that icebergs or sheets of ice loaded with cargoes of boulders, clay, and gravel, were driven or floated over the British Islands, where they dropped their cargoes, and, in many instances, stranded on the hill tops. At this period, the author supposes that the relative levels of land and sea were very different from what they are at present, a great part of the British Islands being then submerged. This theory, the author stated, was not the result of much reflection or observation, and he merely threw it out for the consideration of geologists.

3. Contributions to Optical Meteorology. No. I. On the Polarization of the Light of the Sky. By Professor Forbes.

The author began by recapitulating the observations already made known on this subject.

The facts generally admitted (principally on the authority of M. Arago) appear to be, (1.) That a clear sky reflects light polarized in planes passing through the sun, the eye of the observer, and the point of the sky observed. (2.) That this polarization is a maximum in a zone 90° from the sun. (3.) That in the parts of the sky nearly opposite to the sun, this description ceases to be accurate; for the polarization, in a vertical plane passing through the sun and the observer, vanishes at an angle with the sun considerably less than 180°, —perhaps 150° or 160° (varying according to circumstances),— and gradually reappears in a plane perpendicular to the former, at greater angles than this. (4.) That the polarization is more intense in the neighbourhood of the horizon than of the zenith. (5.) M. Babinet has recently remarked that, under certain circumstances, there is a second neutral point in the neighbourhood of the sun.

Professor Forbes has verified these facts in nearly every particular, by the aid of a modification of Savart's polariscope, constructed of two plates of quartz, peculiarly cut and combined, together with Mr Nicol's single-image calc-spar prism, which the author has substituted with great advantage for the tourmaline commonly used in France.

With this instrument he finds, (1.) That a uniformly cloudy sky exhibits distinct traces of polarization. (2.) That rain-clouds generally polarize light; but not, so far as he has observed, those charged with snow. (3.) That the common rainbow *entirely* vanishes in one position of Nicol's prism (the fact of its polarization was discovered by Biot). (4.) That the polarization of moonlight reflected by the sky is very sensible, and likewise the diffuse light, or *burr*, which surrounds the moon in cloudy weather. (5.) That the light reflected

from dry clear air, between the observer and objects a mile distant, is sensibly polarized.

With respect to the planes of polarization of skylight, he considers that they may be represented by a fiction of this kind: That there is a certain amount of polarization due to the regular reflection of sunlight from the sky in meridional planes passing through the sun and the observer; the polarization being most intense towards azimuth 90°, and vanishing at 0° and 180°. Combined with this polarization is another, distinct from it, and represented by a more intense effect due to reflection *parallel to the plane of the horizon* in all azimuths, which unites with, modifies, and even overpowers the regular polarization in meridional planes just referred to.

The result will be the composition of the effects of the reflection of light at a concave spherical surface having the sun for one pole, with that due to reflection at a cylindrical surface perpendicular to the horizon.

If the latter be tolerably uniform in all azimuths, it will evidently overpower and replace the former in points nearly opposite to the sun, and which become visible when the sun is low.

The author stated his conception of the physical cause for such an arrangement of the planes of polarization to be, that whilst, at considerable elevations, the number of reflecting particles is not so great as near the horizon, the effect due to a single reflection will be the less intense; and, consequently, the horizontal reflection is generally stronger than that in any other plane. But further than this, many familiar facts shew that the horizontal vapours (or opaque particles, of whatever kind they be, which occur in air), are, like a sheet of paper, capable of receiving light and of emitting it, not necessarily in the plane of reflection; and such light, after *several* reflections nearly parallel to the horizon and completely encircling it,—as we often see it do when a slight whitish haze is visible all round,—reaches the eye, much enfeebled, no doubt, by numerous reflections, but more intensely polarized on that account, and reinforced by the number of the reflecting particles. The lights thus irregularly reflected or emitted by the horizontal strata of air, and again regularly reflected by other particles in the same strata, will come to the eye more or less polarized in planes parallel to the horizon. A similar action will produce M. Babinet's second neutral point towards sunset; and Mr Forbes has remarked generally, after sunset, that the planes of polarization no longer converge accurately to the luminary, but are more or less twisted into a forced parallelism to the horizon.

The following gentlemen were duly elected Ordinary Fellows of the Society:—

George Smyttan, M.D., late of the Bombay Medical Board.
James Hamilton, Esq.

The following Donations were presented:—

Researches in Embryology. 3d Series. By Martin Barry, M.D.—*By the Author.*

Quarterly Journal of the Statistical Society of London. Vol. iii. part 4. January 1841.—*By the Society.*

Flora Batava. No. 121.—*By the King of Holland.*

Voyage dans la Russie Méridionale et la Crimée. Par M. de Demidoff. (Partie Scientifique.) Liv^us^ 11 et 12, et planches.—*By the Author.*

The American Almanac and Repository of Useful Knowledge for the year 1841.—*By the American Philosophical Society.*

15*th February* 1841.

Dr ABERCROMBIE, V.P. in the Chair.

The following communications were read:—

1. Farther Researches on the Voltaic Decomposition of Aqueous and Alcoholic Solutions. By Professor Connell.

Since his last communication to the Society, the author has made a variety of experiments, with the view of farther testing the truth of the proposed law which limits the direct action of the voltaic current to the solvent, in solutions of primary elementary combinations in the more important solvents. All his researches have farther confirmed this law in regard to aqueous solutions. Amongst those which he has examined is an aqueous solution of iodic acid as a type of oxyacids; and he found that by connecting such a solution mixed with starch, with a solution of starch in water, by means of asbestus, no iodine was indicated when the starch solution was negative, but was immediately manifested when the iodic solution was negative from the reducing action of hydrogen. In the whole circumstances, he has no hesitation in concluding, "that when aqueous solutions of primary combinations of elementary bodies are submitted to voltaic agency, the dissolved substance is not directly decomposed by the current, but only the solvent."

From his farther experiments on solutions in alcohol and pyroxy-

lic spirit, joined to those primarily detailed, he concludes, that "when solutions of primary combinations of elementary substances, in water and in those liquids, such as alcohol and pyroxylic spirit, which contain water, as an essential constituent, are submitted to voltaic agency, the dissolved substance is not directly decomposed by the current, but only the water of the solvent."

The author had formerly found, that pure ether, and all ethereal solutions then tried, resisted voltaic decomposition. He has since ascertained that when ether, charged with dry muriatic acid gas, is submitted to galvanic action, hydrogen is given off at the negative pole, whilst chlorine is produced at the positive. The cause may either be, that the ether suffers a certain degree of decomposition previous to voltaic action when charged with muriatic acid gas, as is indicated by the effects resulting when it is charged with hydriodic acid gas, water at the same time perhaps being formed, and subsequently undergoing voltaic decomposition; or that the *hydracid* itself, in an ethereal solution, suffers direct voltaic decomposition. But as the author sees no cause to depart from his former conclusion, that ether contains no water as such as a constituent, he thinks it better not to include ether in any general rule regulating the voltaic decomposition of solutions.

In order to shew from voltaic action that the haloid salts are dissolved in water as hydracid salts, the author does not now think it to be necessary to contrast the results with those obtained with alcoholic solutions. He conceives it to be sufficient to shew, that acid and alkali separate from the aqueous solution of a haloid salt, when the poles are plunged in distilled water on each side of it, so as to exclude a secondary action. A little attention will shew that we cannot otherwise account for the separation of the hydracid, when taken in connection with the facts, that the electro-negative constituent of the hydracid also appears at the positive pole, and a definite proportion of hydrogen at the negative when the poles are plunged directly in the solution.

It was found, however, that an aqueous solution of chloride of gold did not shew acid passing into the connected water with the power employed; and hence it is probable that, either from peculiarity of atomic constitution or from the feeble affinity of some metals for oxygen, their haloid salts do not decompose water. The test, however, was found to hold good in regard to chloride of zinc, and therefore in all likelihood in regard to all other metals of a more electro-positive character. The author believes, that even in alcoholic solutions of

moderate strength, an ordinary haloid salt when dissolved, decomposes the water of the alcohol.

The conducting power of solutions is, generally speaking, favoured by the chemical changes which take place in them under galvanic action. Salts act by being resolved into their constituent acid and alkali. Acids and alkalies, in their separate state, act by being transferred to their respective poles in their aqueous solutions. Bromine and iodine are not so transferred; and when they promote the conducting power of their solutions, they act by uniting with the hydrogen of decomposed water.

2. On the Preparation of Paracyanogen, and the Isomerism of Cyanogen and Paracyanogen. By Samuel Brown, M.D. Communicated by Dr Christison.

After a short statement of the discovery of paracyanogen by Professor Johnston, and of its leading properties, the author proceeded to shew how, with certain precautions, cyanogen may be converted entirely, or nearly so, into the isomeric form paracyanogen. This he accomplished by exposing bicyanide of mercury suddenly to the temperature most favourable to the production of paracyanogen, which he found to be a low red heat, and employing also pressure, by confining the cyanogen gas which is at first expelled. By these means he succeeded in resolving the salt almost entirely into mercury and paracyanogen, the latter of which amounted in some trials to more than nine-tenths of the cyanogen contained in the bicyanide. The pressure required was not quite two atmospheres, namely 1.74.

The author further stated, that he had succeeded in proving that paracyanogen once formed cannot be again converted into cyanogen. Professor Johnston supposed the contrary, because he obtained cyanogen gas by exposing paracyanogen to a strong heat. But the author found that this arose from the latter having retained some cyanogen by absorption, that after the absorbed gas is removed heat subsequently expels nitrogen only, and that the same result is obtained from the first by using pure paracyanogen, prepared by dissolving the impure substance in concentrated sulphuric acid, and separating it in a state of purity by leaving the acid exposed to the air so as to attract humidity.

To these facts the author added some views as to the composition of cyanogen and paracyanogen, and their relation to one another. In order to account for the exceeding difference in properties prevailing between these two bodies, which appear nevertheless to consist of

the same relative proportions of the same elements,—chemists generally consider the former to consist of one equivalent of carbon and two of nitrogen (N C_2) and the latter of two equivalents of the former and four of the latter (N^2 C_4). But the author endeavours to shew that the true constitution of paracyanogen is that in which it is regarded as a compound of two equivalents of cyanogen, that is, of two "equal and similar atoms" of the same body.

In conclusion, the author proceeded to apply these views to the constitution of the simple or elementary bodies; and endeavoured to shew that there is nothing unreasonable in the supposition, that,—as chemists are now acquainted with various instances of compound bodies which have widely different forms, different physical properties in general, and different chemical relations, although agreeing exactly in their intimate constitution,—so, in like manner, some of those bodies, which are at present accounted elements distinct from one another, may really be isomeric, that is, different forms of one common element. And he stated that he hoped to be able to adduce experimental evidence of such being the fact with two of the most familiar of the elements, which until now have been considered wholly distinct."

3. A notice was communicated by Mr Mylne from Joseph Atkinson, Esq. of results obtained with Rain-Gauges of different forms.

Graham Spiers, Esq. Sheriff of Edinburgh, was duly elected an Ordinary Fellow of the Society.

The following Donations were presented:—

Journal of the Asiatic Society of Bengal, 1840. No. 98.—*By the Society.*

On the Study of Natural History as a Branch of General Education in Schools and Colleges. By Robert Patterson, Vice-President of the Natural History Society of Belfast.—*By the Natural History Society of Belfast.*